

NEW YORK NEUROLOGICAL SOCIETY.

Stated Meeting, November 11, 1884.

W. J. MORTON, M.D., President, in the chair.

Dr. C. L. DANA read a paper on "Spinal Concussion and the Nature of its Sequelæ."

Dr. Dana summarized as follows :

1. That the term spinal concussion is a misleading and often incorrect one, and that the symptoms which are usually associated with that name are really symptoms of traumatic neurasthenia,¹ hysteria, and hypochondriasis, associated, more or less, with symptoms of injury to the vertebral ligaments and muscles, and to the spinal nerves; that, in other words, spinal concussion is mental shock and physical bruising.

2. That this traumatic neurasthenia is in a measure a real disease, though it is very hard to say how much is real and how much the patient puts on.

3. That it may be, and often is, simulated, and that it requires the greatest care to detect skilled impostors.

4. That we need more objective tests for the purpose of determining the existence of these subjective neuroses.

5. That the prognosis of railway or traumatic neurasthenia and hysteria is very good so far as steady improvement is concerned, not so good as regards complete recovery.

6. That concussion of the spinal *cord* alone, followed by temporary loss of function, or by myelitis, does occur in rare instances.

¹ The term "traumatic neurasthenia" covers a well-recognized symptom-complex which, in some cases, includes a lithæmic condition produced by active, healthy persons being suddenly obliged to lead a sedentary life.

7. That, in the predisposed at least, injuries and jars may set up chronic myelitis, without there being a lesion of the spinal column.

8. That Mr. Erichsen has in his book on "Spinal Concussion" erroneously attributed functional troubles to the results of organic spinal disease.

9. That Mr. Erichsen's book on "Spinal Concussion" has a strong tendency erroneously to attribute to a shaking of the spine and a supposed ensuing meningitis, symptoms really due to mental shock, peripheral injury, or malin-gering.

The accompanying table was also given.

Dr. W. A. HAMMOND said: I agree with Dr. Dana in the view that there is such a thing as concussion of the spinal cord. I agree with him further in the doctrine that it is difficult for us to tell by the symptoms what the exact nature of the injury is that the patient has suffered. But this fact, I think, remains, that there is some injury which the spinal cord is capable of suffering, which is not of such a serious character as to cause death, and which is not accompanied by any injury to the bones, or to the muscles or ligaments. That after all is the practical point.

Dr. Hammond then related the history of two cases of spinal concussion in which he had been called as an expert. The first patient suffered from muscular weakness, spinal pains, severe general nervous symptoms, and walked with a peculiar paralytic gait. There was no positive evidence of organic disease of the spinal cord. He received large damages, but he still, twenty years later, suffers from his trouble. The second case, of a somewhat similar character, made a better recovery, but still walks with a cane. Dr. Hammond thought that this patient suffered from some organic disease of the cord.

The speaker referred to the first case which occurred in this country in which a post-mortem was made. The patient was a physician, who fell on the ice and suffered from the symptoms of antero-lateral sclerosis. On post-mortem, sclerotic patches were found throughout the spinal cord. I think traumatism may give rise to spinal affections without

Nature of injury.	Pathological change produced.	Symptoms.	Result.
Severe blow, fall, or shake.	Fracture or dislocation of vertebrae; compression or crush of cord; perhaps a hemorrhage in spinal cord or canal.	Immediate paralysis or paresis of limbs and spinal centres; anaesthesia; reflexes abolished.	Death occurring soon. Slow improvement, with symptoms of severe organic disease.
Severe blow, fall, or shake.	True concussion of spine (very rare); spinal contusion (very rare); spinal hemorrhage (not uncommon). With above are some injuries to ligaments and muscle, perhaps concealed fracture or dislocation; injury of nerves.	Temporary paresis or paralysis lasting one to six weeks; gradual recovery, spinal pains, symptoms of nervous shock.	Steady improvement and gradual recovery (the rule). With or without a preliminary period of comparative health or temporary improvement, symptoms of traumatic neurasthenia, hysteria (less often), or hypochondriasis, litigation symptoms appear (improvement and cure the rule). In very rare cases meningo-myelitis, insanity, epilepsy, inebriety, diabetes result.
Slight blow, fall, or shake.	More or less bruising, strain, or rupture of muscle and ligaments; some injury of nerves.	Sometimes a temporary paralysis (psychical); symptoms of general nervous shock or of concussion of brain; pains, stiffness, impaired gait.	After a period of comparative health symptoms of chronic meningitis or of chronic myelitis (tabes, lateral sclerosis) develop (very rare and only in the predisposed), traumatic hysteria, or neurasthenia. Gradual improvement the rule, and perfect cure the exception.

there being any palpable lesion of the soft parts, or of the bony structures, or the ligaments.

Only a few days ago I was called to the upper part of the city to see the case of a woman who had fallen through a dumb-waiter, a fire-escape, or something of that sort, which barely allowed her to pass in a doubled-up form. She fell a distance of thirty-five feet, by measurement, into the cellar, striking on her buttocks upon the hard ground. There was no fracture. Three months after the occurrence of the injury I saw her. She was still suffering from paraplegia, and incontinence of urine, and paralysis. Hypochondriasis and hysteria had also developed to an extreme degree. Yet she is rapidly recovering. I do not think there was any hemorrhage in her case, because I do not think hemorrhages of the spinal cord are recovered from. She suffered not only from motor troubles, but from sensory disturbances likewise; also from atrophy of her limbs, showing that the injury involved the whole segment of the cord, both the sensory and motor parts. Yet she has recovered, and I do not believe, therefore, that in her case there was any destruction of the cord. I cannot conceive that there could have been any thing else than a concussion.

Now, I would like to know what it is that happens sometimes when patients lift heavy weights and they feel something give way in the back, and after that they lose the use of their limbs, gradually waste away, and become paralyzed. I have seen such cases. I remember one which came under my observation some years ago, where the patient, endeavoring to lift a heavy window, got his hand in place and lifted with all his might, and suddenly felt something give way in his side. There was no injury there that could be detected by an examination; there was no fracture; no dislocation. And yet that patient gradually lost the use of his legs. What was that? Probably a rupture of some of the fibres of the cord or of the membranes of the cord; certainly an injury to the cord and not of the bony structures about it.

I cannot conceive of the possibility of getting rid of these facts: that the spinal cord is capable of suffering injury,

without there being any detectable lesion of the soft parts, or of the bones, or of the ligaments, or inter-vertebral substance; and that the trouble inside of the spinal canal involves the spinal cord.

Dr. CORNING related the history of a case in which partial impotency persisted long after the accident, and in which there were marked suicidal tendencies. There was not a trace of external injury.

Dr. ROCKWELL considered that organic or structural conditions seldom followed concussion of the spinal cord. Notwithstanding the fact that at the present time he had under his care a young person who was suffering from typical myelitis, ascribed to a severe fall followed at once by incomplete paraplegia, which had gone on to complete paraplegia, it seemed almost incredible to him that a person could have severe concussion of the spine without the cerebro-spinal system in its entirety being involved. In concussion there seldom could be a rupture of the vessels or nerve-fibres without causing death. The majority of cases of concussion that had come under his observation had presented symptoms as manifold almost as those of neurasthenia. The prognosis was generally good, and the best remedy time. The concussion that follows the blow of a bullet was frequently observed during our war.

Dr. HAMMOND added a case of railway injury, in which there was no lesion whatever of the external parts apparent; but there were ocular disturbances (which he thinks are rare, as Dr. Dana says). The patient had double vision, congestive disks, bird vision, and suffered from the symptoms of neuro-retinitis, but they eventually disappeared. He had marked paralysis of the nerve on one side. He was injured in the upper part of the cord; suffered from loss of power in the arms and legs. Had head symptoms, was hypochondriacal and hysterical. He recovered a very large sum from the railway company.

Dr. WEBER remarked that from what he had seen and read upon the subject, it seemed to him that Page was certainly stealing a march upon Erichsen with regard to the views which Erichsen entertains. As I said in a paper read

before this Society upon another subject, the more we shall get into the habit of including a thorough examination of the cord and its meninges in post-mortem, the more our knowledge upon the demonstrable lesions will increase, and the less we shall hear in the course of time of concussion of the spine. I do not mean to say that there is no such thing as concussion of the spine, but I believe that a good many cases which are considered as such are not (in spite of the symptoms pointing that way) dependent upon concussion of the spine, but upon concussion of the brain. Now, the case which has been related by Dr. Hammond, of the woman falling down a dumb-waiter, thirty-five feet, and striking upon her buttocks—taking it for granted that there was a complete absence of all injury to the soft parts and to the ligaments and bones, as Dr. Hammond stated—is a case more of concussion of the brain than of concussion of the spine.

Dr. HAMMOND: To this I can only say that there was no cerebral symptom—that was my understanding—in the early part of the disease.

Dr. WEBER: There may have been, though.

Dr. HAMMOND: I understand not. She never lost consciousness for a moment. I cannot conceive of concussion of the brain without loss of consciousness.

Dr. WEBER: In an abstract of a large number of papers that I read recently, in a volume of Virchow-Hirsch's *Jahresbericht*, I found that most of the leading physicians abroad believe that many cases of so-called concussion of the spine, without any injury to the soft parts or the bones, really depend upon concussion of the brain. Some years ago I saw, at the St. Francis Hospital, a case precisely like the one related by Dr. Hammond. It concerned a young man who had been trying, on a wager with some other man, to lift heavier and heavier weights. While still straining he suddenly felt something give way in his back. He fell down and lost the use of his limbs. When I saw him, two weeks after the accident, there was paraplegia of the lower limbs, and a paralytic condition of the bladder. He remained in the hospital for a time, and, failing to improve, he was at length

discharged. I look upon this case as one of apoplexy of the spinal cord.

Dr. ROBERTS viewed the diversity of opinions as showing a manifest want of conception of fundamental ideas in regard to the subject. He considered the problem one of physics; dealing with a material object, and the forces acting upon it. Among the queries propounded occurs this one: Is it possible for the spinal cord to become concussed without injuring any of the hard parts of the vertebræ? Now, what is traumatism? What is concussion? The effect of blows upon hard, and upon soft or elastic, substances is very different. And we have every reason for believing that this effect differs upon the hard and soft parts of the human body; for the effects considered from the physical standpoint are the same, so far as the mechanical effects are concerned. Vibratory impulses, we find, are conveyed with much greater facility along a hard wooden beam than they are through the atmosphere. Now, if we saw the beam in two and interpose an elastic buffer, it will be found that the sound will not be transmitted; a physical barrier to the transmission of these impulses has been interposed. I may summarize two or three principles which underlie this problem by stating that the harder the substance and the more direct its continuity the greater is its conductivity to jars, to vibratory impulses, to injuries. When a human being is thrown from a vehicle and strikes upon the ground, the force with which he is carried is represented by the rapidity with which the body is moving and its bulk. Now, it took a certain amount of force to set his body in motion, and it would take an equivalent amount of force to arrest that motion. When he strikes against the ground this motion is arrested; he must meet with a force equivalent to that which is represented by his momentum. The force is thus annihilated and is expended upon the jarring. How can these vibratory impulses affect the individual? We must examine the hard and soft parts, and the attitude of the individual, and from our examination of inert physical substances, we have reason to go at once to the bones for the channel through which these vibratory impulses can

most readily be conveyed. The attitude of the patient at the time the blow is received is an important factor in determining the probable amount of injury. If the skeleton is erect and the patient is thrown forcibly upon his feet in the erect attitude, the resulting injury will be much greater than it would be if he were in a crouched position. But then, in this stooping attitude, the limits of the elasticity of his muscles, and the limits of the elasticity of the flexure, may be exceeded when the blow is so severe as to overcome the power of the muscles to maintain this protective attitude. Another important factor to be considered is : whether the patient be fat or lean, for we are dealing with a physical problem. Elastic substances are always the materials with which we annihilate or absorb vibratory impulses. Strike a living skeleton, such as you see in our museums, forcibly upon the breast, and you produce a shock that may result disastrously ; whereas a blow upon a well-developed pectoral muscle is received with impunity.

Dr. GRÆME HAMMOND did not think that there was any question at all that cases of congestion of the spine and symptoms referable to the cord alone did appear after the spine had been in receipt of an injury. He thought the question of the greatest importance was : What is the nature of the trouble with the spine ? whether it is a morbid change which goes on progressively, or whether it is simply functional.

Dr. W. O. MOORE stated that there were two classes of cases met with in ophthalmic practice. The first is that which we meet with merely upon the receipt of an injury to the spinal cord, viz., cases in which there was an increase in the circulation of the optic papillæ, and cases where there was decided neuro-retinitis. In one case there was atrophy of the optic nerve. Whether concussion took place, as claimed by the history of the patient, he could not decide, but two cases in his history-book give decided evidence that concussion of the spine did occur. In one case the patient fell from the second story, striking mostly upon his feet and buttocks. His general health was at once affected, and he was not able to attend to business thereafter. He had

more or less neurasthenic symptoms. Two years later failure of vision was noticed from ordinary atrophy of the optic nerve. Color-blindness then appeared, first for red, then for green, then for yellow and blue, and then it was entirely gone. After ten years' failure of vision he is now totally blind, and has no symptoms of locomotor ataxia or any thing of that sort. In the other case the patient was thrown from his seat on a wagon and fell in a heap, without striking any particular part of the head. Atrophy of the optic nerve took place on one side. The case was under observation about two years, until finally the atrophy was complete, and there was total blindness of that eye. In the other eye he did have for several days, two or three weeks after the injury, a flushing of the optic disk. At one time it was feared that it would likewise become atrophied. The last case was considered by some eye men rather a case of concussion of the optic nerve. That there is a connection between the symptoms of the spinal disease and the eye, there is no doubt. We see it causing atrophy of the pupil, and later on contraction of the pupil. He thinks there is no doubt a connection between the sympathetic and medullary fibres which go to the pupil. In these cases there was no direct blow to the eye nor head, and no laceration or contusion of any soft parts.

Dr. DANA considered Dr. Moore's cases extremely interesting, because they contradict entirely the very positive statements of Mr. Page in his work on "Injuries to the Spine." He then read the following letter from Dr. Allan McLane Hamilton regarding this subject:

"While I have been satisfied, from a very varied experience, in court and elsewhere, that the vast majority of those who claim compensation for railway injuries are malingerers and impostors, I still find that nervous shock is quite apt to develop a 'railway hysteria' in some, which is in every sense a real disease, and is due to actual physical disease, and in others to the development of a morbid expectant attention. It is unnecessary to adopt the extreme opinion of either Erichsen or Page. There is in sixty per cent. of the cases an intermediate condition in which subjective

symptoms are the only ones. In some of these cases the hemianæsthesia, lately described by Putnam, may be detected by abstract tests. In others we are furnished with vague yet unmistakable disorders of a functional yet serious nature. I strongly disapprove of the injustice of juries who manifest an asinine disregard of scientific proof, and award enormous damages because of prejudice against corporations, simply upon the story of the plaintiff. On the other hand, there are cases turned out of court when some award *should* be made. I do believe that in the great number of well-established cases of railway hysteria, that *moderate* verdicts should be rendered, just as they are in punitive libel cases when the peace of mind has been hurt. In the majority of cases no speculative damages should be allowed upon a simple personal relation of symptoms."

Dr. J. G. JOHNSON, of Brooklyn, asked Dr. Moore whether, in the case he mentioned, there was a connecting train of symptoms that showed that the blow did the injury.

Dr. MOORE replied that the man who fell from the wagon was seen thirty-six hours after the injury. He had failure of vision from the very beginning; in that case he had flushing of the optic nerve and decided symptoms of neuro-retinitis. This gave way after a period of two years, and atrophy developed.

Dr. HARWOOD remarked that, out of a number of sufferers from railway accidents, he recalled two cases of spinal concussion. He advised the patients and the corporation to settle amicably. But his advice was not taken in either of the two cases, and they finally went to trial. His view was sustained by the jury, and a verdict was secured for the plaintiff; but what is very unusual in these cases, as he had observed them in suits that had been brought, these patients ultimately died from the results of their injuries.

Dr. ADAMS observed that most of the cases that showed any injury after a concussion generally showed it in the lower extremities. Many cases of Pott's disease were recognized by most authorities to be caused by concussion. It would appear that the milder injuries caused ordinary concussion of the spine, and more severe ones Pott's disease.

Dr. J. G. JOHNSON: I only wish to say that a fact, which would militate against any such hypothesis as that, is that, in the case of vertebral caries, which, according to this theory, is supposed to result from more severe injuries, we have none of the symptoms of spinal concussion. I merely want to ask the neurologists one question, and that is, if they have ever seen a case of spinal concussion in a railway employé (who takes the risk of the conveyance) without the physical symptoms showing either meningitis or myelitis? These anomalous symptoms, which are laid down by Erichsen with such fluency of language, I have never seen in my twenty-five years' experience as a railroad surgeon. I have never seen a single railway employé have them. And for this reason: Dollars and cents do not enter into the consideration of the railway employé. He has every inducement to get well; he has his family to support; if he does not get well in a reasonable time he goes out, and somebody else takes his place. On the other hand, the man who has been on a railway train, who has a good shaking up and a terrific scare, has no object in getting well. The company has got to pay him roundly; it has to pay him for his loss of time; it has to pay him for his suffering, both mental and physical; it has to pay his surgeon also; his surgeon has an unknown quantity to handle; he has something to treat that the patient does not understand. If the patient has a broken leg he knows what he has got, and the doctor cannot come in and discuss spinal concussion symptoms, and all that. He has seen broken legs before; has had cold extremities, vomiting, exhaustion, and so on; but he has not had the scare of a doctor coming in, feeling up and down his back to see whether it pains him, and asking him whether he can stand on his legs, and going through all those symptoms, that unknown quantity which they know so well to do. He has not had some confrère to come in and suggest some more doubts. The doctor, in a good many cases, is hungry, and the big corporation may pay his bill. He has to examine that back often; he has to find out just what these doubtful things mean; and the patient, having it iterated, and reiterated, and reiterated

again, begins to believe himself that there is something terrible the matter with him. He does not dare to go out and take a little fresh air and exercise (which, as my friend, Dr. Hammond, says, is the best thing to restore the nerves), because a railway man might be around and spy him using his limbs. He gets morose, and has no object to get well, because that suit is not settled.

I think there is no doubt that serious lesions of the spine and spinal cord do occur as the result of railway concussions. We have also mingled with it a large variety of other symptoms. When a train is suddenly stopped, the patient is violently thrown backward and forward, shaking up all the viscera, and the whole sympathetic nervous system and the other organs suffer. Added to that, this terrific fright and the utter helplessness of their condition, the effect upon the mind is something which is severe. But with all that, when you come to consider the fact of compensation, we find these cases so much aggravated that I do not think any physician is right to go into court and swear that the patient has disease of the spine unless he has the physical symptoms, and he should not simply rely upon the statement of the patient, who is interested to make matters as bad as he can.

I saw an extremely interesting case some years ago, which was the result of a railroad disaster on the New York Central Railroad. The patient, a lawyer in this city, was in a sleeping-car when it was derailed. He was thrown down an embankment, and I saw him the next day but one. He was in such a condition that he was put on a return train and came to Brooklyn. There were marked contusions of his shoulders, abdomen, breast, back, and hips, showing that he had received a violent rolling over. Some thirty-six hours from the time of his injury his limbs began to fail him. He could walk if he was watching where he placed his foot. If he walked, and you would speak to him, he would tumble over. That increased, and paralysis of sensation followed, until it extended up as far as the ninth dorsal vertebra. There was no shamming about it. I tried electricity; I burned his legs with matches, and things of

that kind, which he would not have been able to stand if it had been felt. Dr. Ranney saw the patient on behalf of the New York Central Railroad Company. The case was settled at about twenty thousand dollars. Dr. Ranney based his claim that he would recover on the fact of there being no wasting of the limbs. I at that time held the opinion that it was an extravasation of the blood around the substance of the cord; I did not think it could be in the pith, from the fact of its being limited to the nerves of sensation and not of motion. After that he recovered entirely and thoroughly, and his own physician and myself, who examined him subsequently, failed to find any indication of any physical pain whatever. He recovered in about six months.

There is a point of interest in regard to these spinal cases alluded to by Erb, that I would like to hear about from the neurologists. Men long connected with railway trains, as engineers, after a while lose their snap; they don't get in on time. Finally, they show a complete nervous break-down. Erb alluded to this particularly. What change has probably taken place in the old railway employes where there is this nervous break-down, which shows itself by a lack of courage and nerve-power, and by gradual failure? These cases are becoming extremely interesting in Germany, where the railway employes are allowed damages, just the same as passengers on trains, and this old, worn-out railway nervous system is being put in as a spinal concussion.

Dr. BIRDSALL thought that these cases were a good deal rarer than the general impression would lead one to conclude. The prominence which the work of Erichsen had been given, had led people to look for effects of spinal concussion, and to talk about them a good deal more than was really admissible from the facts of observation.

He had been led to conclude that many patients had, previous to their concussion, what was ordinarily termed neurotic or neuropathic constitution.

It had been stated by Dr. Weber that many of these symptoms were cerebral. He thought that they were de-

veloped probably as much from fright as from concussion of the spinal cord. On the other hand he would not be understood as denying the existence of functional, and perhaps something more than mere functional, disturbances of the cord from concussion. There was a good deal of difference between a single shock, a severe shock due to railroad accident, and the continual jarring which went on in a man in the cab of an engine. It seemed to him that in a healthy person, while the former might be readily recovered from, the latter, even of a more moderate character, would prove more injurious, and he should certainly be very careful about classing them in the same group.

Dr. JOHNSON said the length of time, doubt, and uncertainty of the cases are important elements to consider. As far as a surgeon for a railroad company being affected in his evidence by outside influences is concerned, he would find that truth was the first essential; he would not hold his appointment for twenty-four hours when his company was satisfied that he was not truthful. When we are sent to investigate a case on behalf of the corporation, we make as thorough and as exhaustive an examination as it is possible with the knowledge that we have, and our report is made in writing and goes to the company's office, with every thing bearing against us as well as bearing for us. If we misrepresented that case, and this is shown in evidence in court when the case comes to trial, it shows that we are ignorant or dishonest, and our walking tickets are prepared. No man can hold his position as a surgeon for a company who is not honest, because they pay by dollars and cents on an opinion, and if it is not truthful they do not want it.

LUTHER R. MARSH, Esq., said he was bewildered by the medical phraseology, which transcended that of the legal guild in the magnitude of its technology. If he were to ask the doctors the difference between "the whole of an undivided moiety, and the moiety of an undivided whole" they would understand his meaning, but they could hardly use a neurological sentence that would not send him to his dictionary. When quite a young man he had written an article for a local newspaper, without regard to sense, but

simply for the cadence of the sentences. The beginning of that article, which the good people of the town puzzled over with their glasses, ran as follows: "Pedaneous are the gorgeous geoponics of saginated hoplites." But while his big words were without meaning, theirs were not. He had gleaned from them that the spinal cord was certainly capable of injury, without any necessary harm to its bony or other coverings. The paper had seemed to him eminently impartial, steering a midway course between what the transportation companies might call the extravagances of Erichsen, and what suitors for personal injuries might class as the perversions of Page. He had also learned that when a man has been concussed, as the doctors called it, in the nerve-centres, he was never thereafter fully himself again. He did not, however, consider the word "concussed" felicitous. He was pleased to learn from Dr. Roberts that it was a good thing to be fat, and have a shield between one's self and harm. He considered this well shown in Dr. Hammond's case, where the woman was saved by landing on the voluminous natural cushion of her seating apparatus. The insinuation which had been made, that the consideration of the fee could swerve the testimony of the physician, he repudiated, and said that he stood up for the honor of that sacred calling which deals with the mysteries of human life, and which he had always held in reverential regard. From Dr. Dana's paper he had seen that he agreed with Chas. Sumner, that what a man most needed was backbone; that wonderful combination which enabled a man to stand erect, and firm, and unbending, in all emergencies.

Dr. DANA: I only wish to say with regard to one or two points that Dr. Johnson raised, first, with regard to employés not suffering from this concussion of the spine; I think he will find the symptoms of concussion of the spine, as delineated by Dr. Erichsen, were described by Dr. Abercrombie twenty-five years before Erichsen wrote, and his classification of spinal injuries would hold good now.

He was very glad that Dr. Johnson brought out the great importance of the malingering element, because it is an important one. Every one knows there is a prejudice in

juries against corporations. There are certain courts where a corporation cannot get a verdict any way, at least so the lawyers say. Therefore, I think that in justice we ought to keep that fact of malingering before us as being a very important one indeed.

As regards the trouble brought on in locomotive engineers, he thought that Dr. Johnson would find that Dr. Rigler, whom he quoted in his work on "Injuries of the Spinal Cord," has devoted a good deal of attention to this disease, which he calls sideromorphophobia, or fear of railways. He did not think that it was due to continuous concussion alone, because it occurred in locomotive engineers more often than in other employés. It seemed to the speaker that the constant strain and anxiety which these engineers suffered were very important elements in producing it.

In conclusion, he said that there was a class of cases that had not been much referred to in the discussion. Nervous and hysterical women, when frightened or injured on a railroad, were very liable to go to bed, and, under the sympathizing influence of friends and the prospect of large damages, develop a functional paraplegia with symptoms of spinal irritation. It was often hard to tell the exact amount of real injury for which the company was responsible. As a rule the companies were unjustly mulcted, though sometimes the trouble became a real one.

Stated Meeting, December 2, 1884.

W. J. MORTON, M.D., President, in the chair.

Dr. E. C. SEGUIN explained "A Method of Aniline Staining for Large Sections of the Brain," which had given him very satisfactory results. It consisted in a modification of Sankey and Bevan Lewis' method. In order to insure the best effects, it was necessary to allow the sections to absorb the dye slowly. The solution employed was an aqueous one of aniline blue black, having strength of one to two thousand. In this the sections were completely immersed and allowed to remain for from twelve to sixteen hours. They

were then washed, dehydrated, and mounted in balsam. He had not tested the value of this method for the study of minute histological details; but for examination with the naked eye he thought the method was superior to most others, especially in bringing out a sharp contrast between white and gray substances.

Dr. STARR had tried aniline black for smaller sections, but had not been pleased with the results. Recently he had used Weigert's hæmatoxylon method and found it eminently satisfactory. He thought the two methods might be advantageously combined.

Dr. WENDT remarked that such a combination would probably produce too great a mixture of colors, thus marring the distinctness of detail obtainable by either method when employed alone. Weigert's method was a good one, but required much care, skill, and time. As a general thing, the simpler a method, the more satisfactory would be its every-day use.

Dr. BIRDSALL was a believer in the chloride of gold for neuro-histological work. He was aware of its uncertainty; but the good specimens, which he had succeeded in preparing, were so beautiful as to compensate for the complete loss of other sections.

Dr. SACHS said that the difficulty of a method was hardly a valid argument against its employment. He instanced the staining process of Freud, of Vienna, which brought out the nerve-fibres quite black, upon a purple background. The paths of the fibres thus became particularly well marked.

Dr. J. LEONARD CORNING read a paper entitled "The Circulation in the Brain as Influenced by Electricity." He first referred to some previous studies, undertaken in order to determine the therapeutic applicability of the mechanical regulation of the cerebral circulation, the results of which were published in *The Medical Record* of February 18, 1882. The instrument which he at first devised had since been improved upon. The essential features of the new appliance consisted in a metallic fork, having a handle four inches long, and provided with two prongs resembling those of a large tuning-fork. To the

extremity of each of the prongs was attached a narrow sponge electrode. The prongs could be made to approximate or separate from each other at will by simply rotating the screw in the handle. It was thus possible, when the instrument was held at right angles to the neck, to adjust each pad with great accuracy over the corresponding carotid. When a galvanic current was conducted to these small electrodes by means of a bifurcated rheophore, secured to the negative pole of a galvanic battery, while the positive electrode was placed below the occiput, it transpired of necessity that all the structures interposed within the circuit were more or less affected. As a natural consequence the most pregnant expression of the activity of the electric current would be found in a greater or less modification of the functions of the involved nerves, namely, the sympathetic and pneumogastric.

The physiological results obtained in this way were due to: 1, arterial pressure; 2, contraction of the cerebral capillaries; 3, retardation of the heart's action. Besides these, we should doubtless have to include effects produced by threads of current upon the medulla, as well as collateral phenomena not easily amenable to analysis. Thus the phenomena which he had succeeded in evoking by the aid of this instrument were substantially as follows:

1, Dilatation of the pupil; 2, drowsiness; 3, dizziness (where strong currents and considerable pressure are employed); 4, drooping of the eyelid; 5, retardation of the heart's action (where exclusively strong currents are employed); 6, pallor about the lips and frontal region; 7, muscular weakness, as proven by the dynamometer—the subject, if standing, complains of weakness in the knees; 8, in anæmic individuals syncope may be produced, should excessive pressure and strong currents be employed; 9, the excitement incident to the primary stage of etherizations is cut short by resort to this method.

Having employed the instrument described in a variety of neuroses, particularly in migraine and epilepsy, with more or less success, the thought occurred to him that the efficacy of the procedure might perhaps be enhanced if some

means were devised by which compression and galvanization could be employed for more or less prolonged periods of time.

Accordingly, after many trials, he devised an appliance which appeared to fulfil all reasonable indications. It consisted in the first instance of an elastic belt, which encircled the neck, and to the centre of which was secured a framework of metal, resembling somewhat in shape that of a horseshoe. To the extremity of each branch of this apparatus was secured, by means of a ring and screw, a narrow, adjustable electrode, insulated by the interposition of a thin segment of hard rubber. The branches might be dilated or approximated at will by the aid of a screw which protruded anteriorly through the centre of the elastic belt.

In order to adjust the instrument the branches were placed on either side of the larynx in such a manner that each narrow electrode rested above the corresponding carotid. The branches were then carefully adjusted by the aid of the screw. The belt was then tightened and secured behind by means of appropriate buckles. The pressure was only carried to a sufficient extent to insure slight compression of the lumen of the artery, and not to such a degree as to cause the slightest inconvenience to the patient. By means of a bifurcated rheopore both electrodes were secured to the negative pole of a galvanic battery. A broad electrode, which was appropriately secured to the belt, was now placed upon the posterior aspect of the neck, and attached by a single rheophore to the positive pole of the battery. The current was then gradually increased, great care being taken in the execution of this portion of the operation. A water rheostat should be employed if possible, and the procedure should never be carried to such a degree as to produce tinnitus, dizziness, or extreme pallor about the ears and face.

In closing, Dr. Corning said: "I have employed the above apparatus in the treatment of a large number of neuroses. In epilepsy, congestive headache, mania, insomnia, and the convulsions of children it has surpassed my most ardent expectations. In the hyperæmic conditions of the

brain, incident to the prolonged abuse of alcoholic stimulants, and in other forms of vaso-motor insufficiency its prolonged employment has yielded excellent results. A noteworthy circumstance is the fact that the primary stage of excitement incident to etherization is effectually aborted by the use of electro-compression; and, indeed, the same may be said of simple pressure applied to the stems of both carotids, as abundantly shown by the observations of my friend, Dr. M. J. Roberts, of this city. Dr. Chichester, of New York, also tells me that he has succeeded in causing a permanent diminution in the rapidity of the heart's action in a patient suffering from exophthalmic goitre, by employing one of my instruments for electro-compression. Besides the above effects, which speak for themselves, I have recently had occasion to obtain additional proof of the pronounced influence exercised by this procedure upon the cerebral circulation. I applied the instrument to the neck of an infant whose fontanelle was still open, and observed that, when an interrupted galvanic current was employed, there was a perceptible sinking of the tissue above the opening.

"These phenomena are conclusive, even when interpreted in the light of the most guarded conservatism. Taken in conjunction with the results obtainable at the bedside, they may be urged in extenuation of the present researches in the cause of physiological therapeutics."

Dr. ROCKWELL said that he had no doubt that by electro-compression the brain and sympathetic system could to a certain extent be affected. But the main action of the apparatus was restricted to the surface. He did not believe that the cerebral circulation could be seriously disturbed by it. In all such investigations the varying degree of susceptibility should be taken into account. After applying electricity to the head some would experience profound drowsiness, others would feel scarcely any thing. He did not know whether the results were due to direct cerebral action, or depended upon the intermediate agency of the circulation. He thought that perhaps electro-compression might prove a valuable adjunct to other treatment, just as galvanism pure and simple did.

Dr. ROBERTS said that compression alone had acted well in some cases in his experience, notably in one case of infantile convulsions. An immediate subsidence of struggling had followed gentle digital compression of the carotids. Of course, further practical tests were necessary to substantiate the reader's claims.

Dr. SEGUIN saw no theoretical flaw in the method, and thought it deserved to be tried. Ophthalmoscopic examination might decide whether, and to what extent, cerebral circulation could be influenced by it.

Dr. BERG remarked that it seemed doubtful whether the sympathetic could be galvanized through the integument. He had failed to observe dilatation of the pupil, after using the current for fifteen minutes over the sympathetic.

Dr. CORNING replied that he had seen dilatation.

Dr. ROBERTS believed that the action of electricity might penetrate deeply, just as counter-irritation produced other than merely superficial effects.

Dr. WEBSTER stated that he had been unable to discover any change in the retinal circulation during compression, but perhaps this was owing to imperfections in the apparatus at the time of experimenting. He added, with regard to the relation between ocular and cerebral circulation, that hyperæmia or anæmia of the eye might occur independently of a similar condition in the brain. Strong carotid compression should certainly affect retinal circulation in a visible way.

Stated Meeting January 6, 1885.

W. J. MORTON, M.D., President, in the chair.

A paper on "Æsthesiometry" was read by GRACE PECKHAM, M.D.

Under this title the methods of investigating the cutaneous sensory apparatus were considered.

I. General or common sensation is tested by pricking, pinching, tickling, or, best of all, because more accurate and because one is able to determine by it the amount of time requisite for a sensation to reach the nerve-centres, the faradic current.

II. Tactile sensibility.—I. *Sense of pressure*.—Several instruments have been invented to record the power of the individual to determine mere pressure.

Weber's is the simplest. It consists of a rod, with a disk of wood, as a non-conducting substance, to place flat upon the surface of the skin. The weights are arranged with a hole through the centre, so that they can be strung upon the rod.

Dohrn's instrument consists of a non-conducting disk arranged on a spring, so that upward pressure is recorded on a scale.

Eulenburg's paræsthesiometer is a spring balance with a dial to record varying pressure. He has found, in observations with this instrument, that a differential pressure of one thirtieth to one fortieth of an inch can be discriminated by the skin of the face, one twentieth to one tenth of an inch by the skin of the hand, arm, and anterior aspect of the thigh, leg, and dorsum of the foot.

Goltz' instrument, an india-rubber tube filled with water, whose waves in rising and falling record the smallest variation possible, is the most accurate.

It is interesting to find that the scale of pressure-results corresponds very accurately with those of Weber for sense of locality, with the exception of the tip of the tongue, which stands much lower.

It should be remembered that a colder weight is felt to be heavier than a warmer one, and that the sensitiveness is greater for an increase than for a decrease of the difference in weights, and also greater for a small absolute pressure than for a large absolute pressure.

2. *Sense of temperature*.—Numerous are the devices for determining temperature, varying from the simple methods of plunging the extremities into hot and cold water, blowing on the skin at a distance to test sensation of cold and breathing upon it to test that of warmth, the using, as did Weber, of test-tubes of oil heated to a known degree, to the complicated thermæsthesiometers of Eulenburg and Nothnagel, both of whom made the most delicate experiments possible. Nothnagel has shown that the small variation of 0.2° F. can

be distinguished in the most sensitive portions of the body, and 0.4° in the least sensitive.

3. *Sense of locality*.—This, of the various manifestations of sensibility, is the most commonly tested, and for this purpose Sieveking invented the æsthesiometer. Observations, as is well known, are based upon the physiological fact that two tactile impressions at certain distances, these distances, variable in different parts of the body, become fused into one. Sieveking's æsthesiometer was made with one point fixed, the other movable upon a bar upon which is a scale. Weber used a pair of compasses. Other æsthesiometers have been modifications of these two ideas.

During a year of testing with the æsthesiometer, while making a careful study of metallotherapy, I was often led to notice the difference made in the quickness of perception



by varying simultaneously the pressure of the two points. It occurred to me that an unconscious variation of pressure might easily mislead the investigator. An æsthesiometer which, without being clumsy, would record pressure, would be a desirable instrument. The æsthesiometer after the Sieveking pattern is, I think, more easily managed than that modelled upon the compasses. I therefore had one made like Dr. W. R. Birdsall's, which is on this principle. It is light, has a concealed needle, and can be attached to an electrode when the screw at the end is removed. Mine differs from his only in that the points are attached to spiral springs which allow of upward pressure. These springs are attached to a small rod, which is divided into degrees, each of which represents a pressure of 30 grms.

The instrument might also be used to test simple pressure

by adjusting to one of the points a disk of non-conducting substance, as wood. To test roughly the sense of temperature, two disks might be fixed to the two points, one of wood and one of metal.

A slight degree of pressure, almost unconscious, records thirty or sixty grammes, and yet it makes a great difference, often narrowing what the Germans call the sensation or tactile diameter one third or one half. The extent to which pressure increases the power of discrimination varies in different parts of the body. It is much less where the sensibility is most acute, as at the finger-tips.

By way of illustration simply of æsthesiometric variations with and without pressure, the following two cases are given.

In CASE 1, that of a young man, an ordinary æsthesiometer showed no difference between the two sides of his face, but he had a feeling of numbness in the left.

RIGHT SIDE. ¹		LEFT SIDE.	
Forehead, (24 mm.)	— P. 8 mm. 5 mm. + 2° P.	Forehead,	— P. 8 mm. 5 mm. + 2° P.
Cheek, (11.25)	— 5 P. mm. 4 to 5 mm. + $\frac{1}{2}$ ° P.	Cheek,	Answer less prompt. — P. 7 mm. Same + $\frac{1}{4}$ ° P.
Chin,	5 mm. + P. or — P.	Chin,	— P. 8 mm. 6 mm. + 1° P.
Neck, (33.75 mm.)	5 mm. + P. or — P.	Neck,	— P. 7 mm. 5 mm. + 1° P.

This case shows that the slight difference between the two sides without careful regard to pressure would be lost.

CASE 2.—Woman who complained of left leg, with constantly increasing inability to use it in walking. Diminished faradic excitability in both nerve and muscle.

RIGHT SIDE.		LEFT SIDE.	
Thigh, (77.5 mm.)	— P. 35 mm. 10 mm. + 2° P.	Thigh,	— P. 35 mm. to 45 mm. 15 mm. + 1° P.
Anterior of leg, (40.5)	— P. 40 mm. 29 + 1° P.	Anterior of leg,	— P. 40 mm. 20 mm + 1° P. (Marked hesitation.)

In order to make more accurate observations with the

¹ — P. denotes use of æsthesiometer without pressure, + P. use of pressure, 1° = 30 grms. The figures in parentheses show the distances given in Weber's tables as normal for the parts.

æsthesiometer, therefore, the following suggestions are made:

1. The same pressure should be used for corresponding parts which are compared or tested; if variations take place they should be recorded.

2. When comparing parts, the points of the æsthesiometer should be used in the same direction—that is, either longitudinally or transversely, remembering that in the latter case the tactile diameter is smaller than in the former, a distinction made by Wundt, who says that Weber's *Empfindung-kreise*, or circles of sensibility, should not be circles, but ovals. Nevertheless, Weber recognized this fact, and gives as exceptions the tips of fingers and tongue.

3. The response may vary, so Ross says, with the direction in which the points of the æsthesiometer are approached or separated; they are appreciated at less distance when commencing with the points wide apart and then having them approach one another.

4. Both points should be applied simultaneously, and with equal pressure.

5. One part should not be tested too long. The patient soon becomes weary of answering, and indifferent in his responses. Moreover, the attention really becomes fatigued. Again, if the tests are made too rapidly, the sensations, like those of the other special senses, become confused.

6. The nature of the response demands consideration, whether it is prompt or hesitating. If the latter, whether the slowness is due to a natural inability to respond quickly to external stimulus, or whether it depends on the presence of an abnormal state. It must be remembered, too, that the centres can be educated, so that improvement noted from time to time may be due to this.

7. The patient, of course, should not look, nor should the instrument be used according to the preconceived notion of the patients.

One of the most important considerations in connection with the subject is what should be considered the normal distance at which the two perceptions become distinguishable. The table most often quoted is that of Weber.

Vierordt has confirmed it, as have, after careful experimentation, Kottenkamp, Ullrich, Paulus, Riecker and Hartmann. Sieveking and Valentin have also given scales. The distances of Valentin are much less than those of Weber. As a general thing I have found them less than either. The cases already given to show differences of pressure will indicate this, and they are typical.

The matter is comparative rather than definite. Wide variations may occur because of environment. According to my experimentation, in comparison to the tables given by Weber, the Germans have less of the *Raum* or *Ort-sinn* than Americans or those who have resided in this country a long time.

Goltz and Czermak have stated that the touch diameter is much less for children than adults, such whose intelligence could be relied upon to answer. It is probably because the skin is more delicate. For this same reason there would be variations between men and women, between those whose skin was protected and those whose skin was not.

It is therefore a matter of comparison between corresponding parts of the same individual rather than between individual and individual, hence the importance, in order to obtain correct results, of making the tests of these corresponding parts exactly alike as far as possible, by placing the points in the same manner, and in regulating the pressure.

In the discussion which followed, Dr. DANA alluded to the general lack of precise knowledge concerning æsthesiometry, and thought that Dr. Peckham's instrument would aid in making matters clearer. The normal sensibility of the skin had been differently described by different authors. For practical purposes it seemed best to distinguish between common and special sensation. Temperature and pain belonged to the former. Special or tactile sensation revealed contact, pressure, and locality. So-called muscular sensation should be placed half-way between common and special sensation.

Dr. BIRDSALL said that in Dr. Peckham's instrument the additional contrivance for estimating pressure was very

valuable for purposes of careful physiological examination. It was necessary always to be very cautious about attaching diagnostic importance to the responses of patients. The practical use of ordinary æsthesiometry was limited to coarser tests. The additional estimation of pressure-sensibility might make the test more delicate and useful.

Æsthesiometry might show that in a given case there was general slowness of appreciation, rather than actual tactile disturbance.

The President thought that the instrument of Dr. Peckham might be further improved by attaching a scale in such a way that an accurate record would be had of the amount of pressure used. Unless this addition be made, different observers would necessarily record different results. With an agreement as to a normal standard of pressure this source of error would be obviated. In this way we might soon have a series of systematic observations, that would be a great help, especially in practical office examinations.

Dr. PECKHAM remarked that her æsthesiometer was intended for the determination of cutaneous sensibility merely. The muscular sense would have to be tested in other ways. In order to have exact records of the amount of pressure employed, water would have to be used as a recording medium. This, however, would make a clumsy instrument, and one not readily carried in the pocket. Besides, æsthesiometry was intended, not for absolute, but only comparative results. If, in place of a water-gauge, metallic springs were employed, they would yield after a certain time, unless very conscientiously tempered, which would make such an instrument too costly.

Dr. B. SACHS then made some remarks on "The Use of the Absolute Galvanometer," and demonstrated Hirschmann's new instrument. (See p. 19.)

Dr. JACOBY had seen Hirschmann's instrument in active use, and was convinced that it was the most perfect apparatus of the kind yet devised. He believed it to be quite independent of terrestrial magnetism.

Dr. BIRDSALL remarked that one objection to all vertical galvanometers consisted in the fact that their magnetic

intensity might change. The skilled labor involved in constructing good apparatus of this kind had led American instrument-makers to avoid manufacturing them. He believed that the importance of the galvanometer was more apparent for purposes of accurate diagnosis than for therapeutical efforts. General practitioners had certainly been able to obtain beneficial results without resorting to the use of accurate current measurements.

Dr. BERG said that the scale on the vertical galvanometer should not be made up, as in Hirschmann's instrument, of equal distances, as the factor of gravity was thus left unprovided for.

Dr. SACHS pointed out that the instrument was particularly useful for general practitioners, who only made occasional use of their batteries. The number of cells employed could not be a measure of the strength of the current. And in this way injury in place of benefit might result, especially whenever the head was concerned. With both poles on the head currents of more than $1\frac{1}{2}$ — $2\frac{1}{2}$ M. A. should never be used.